American Journal of Public Health
and THE NATION'S HEALTH VOL. X NO. 2

Volume XVIII February, 1928 Number 2

What Can We Do About Measles?*

GEORGE C. RUHLAND, M. D., FELLOW A. P. H. A.
Director, Syracuse Health Demonstration
and
A. CLEMENT SILVERMAN, M. D.
Director, Bureau of Communicable Diseases Syracuse Health Department, Syracuse, N. Y.

THE ultimate conquest of measles depends no doubt upon the discovery of the specific causal agent and the development of an immunization procedure, similar to that now employed against diphtheria and scarlet fever. Perhaps the dawn of the tomorrow that will bring this achievement is not far distant; certainly the laboratory research worker is busily endeavoring to determine the etiology of this disease.

At present, however, there still seems considerable doubt as to the identity of the specific organism. Whether the green streptococcus of the Tunnicliff [1] type will prove to be the real cause, whether it is the green diplococcus of Ferry,[2] or whether these are merely variant symbionts and the true causal agent is a filtrable virus other than those mentioned, as Park [3] suggests and Degkwitz [4] insists, the future must determine.

In the meantime the health officer faces the fact that measles occurs with distressing regularity of from 2- to 3-year intervals and spreads rapidly in spite of the usual control measures.

A recent survey by the U. S. Public Health Service, based on inquiries made of several thousand university students in different parts of the United States,[5] shows that approximately 90 per cent of males and 95 per cent of females 20 years of age and over had suffered attacks of measles. This indicates fairly well the still widespread prevalence as

* Read before the Health Officers Section of the American Public Health Association, at the Fifty-sixth Annual Meeting at Cincinnati, O., October 17, 1927.

well as the high incidence of measles. The factors that are responsible and contribute to the usual rapid spread of measles are, of course, well known.

There is the exceptionally high degree of infectiousness of the disease itself, the difficulty of recognizing and so controlling the disease during the prëruptive stage, when infectivity is highest, and the unfortunate popular belief that measles is after all only a negligible disease of childhood with a corresponding indifference and lack of coöperation on part of the public. A sense of hopelessness in the face of these overwhelming adverse odds no doubt is responsible for the general lesser interest that characterizes official activity when dealing with measles.

This attitude on the part of the health officer, Dr. Godfrey [6] maintains, is an additional reason why better progress in the control of measles has not been made so far. Agreeing that with present facilities any attempt to prevent *all* measles is foredoomed to failure, he suggests that action should concentrate on a program to protect especially children under 3 years of age, since after all fully 70 per cent of all measles deaths fall within that age period.

Although Brownlee, in England,[7] urged a similar program for the protection of child life in the early age group, it appears that nowhere was a consistent effort made to try out such a plan.

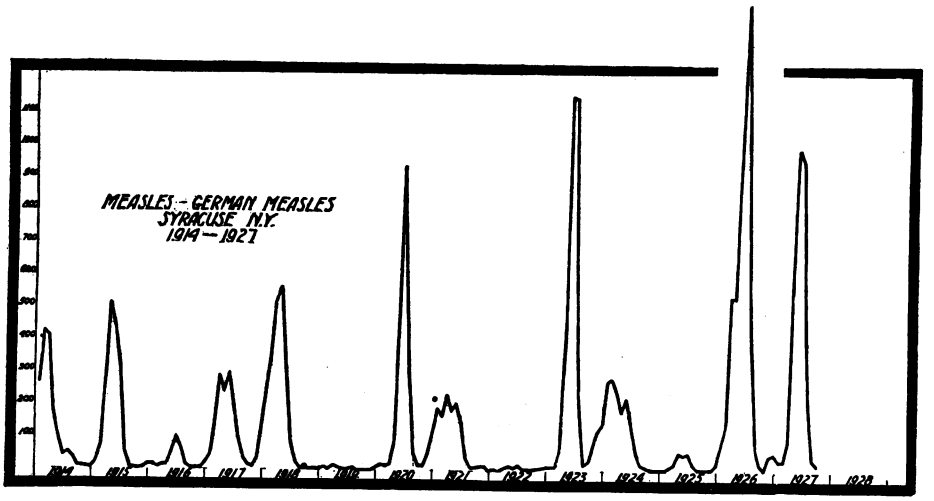
An opportunity for such a practical tryout of the plan presented itself to us in Syracuse in the late winter of 1926. A study of the history of measles in Syracuse shows that measles appears there in 3-year intervals. The outbreaks, beginning usually late in February or early in March, run through 2 years, with a summer remission each year, showing a crest of the epidemic wave in May, which then falls rapidly in June. With a record of a measles epidemic in 1923-24, it was therefore a simple matter to forecast the next epidemic for 1926-27. See Chart I.[8]

PLANS AND PROCEDURES

Knowing that an epidemic of measles was impending, the next step was to plan for action that would secure as much protection as possible for children under 3 years of age. Three things seemed especially important to this end:

1. To arouse the public, especially those families having children in the dangerous age group
2. To secure the coöperation of the medical profession
3. To develop the departmental machinery, i.e., especially the nursing staff

For the first of these steps the press was taken into our confidence. Through the daily papers announcement was made, even in the fall of the year 1925, that according to past experience Syracuse would have



Profile showing periodicity of measles at Syracuse

an epidemic of measles beginning in the late winter or early spring of 1926. It was pointed out that, contrary to common belief, measles, through complications, is a dangerous disease, especially to children under 3 years of age, and to all delicate children. Since it was difficult to recognize measles during the early stages, all children exhibiting any symptoms of a cold should be put to bed, kept separate from other children, and a physician called to pass upon the case. Warnings were also issued against the seriousness of complications which might follow if children were allowed to leave bed too early during the convalescent period.

All cases were to be reported promptly to the Health Department. The medical profession was likewise informed through the department's *Weekly Bulletin* of the impending epidemic, and the use of human convalescent immune serum was urged and offered for children of the dangerous age group. Special pains were taken to impress upon the nurses of the department the high degree of contagiousness of measles, the usual modes of transmission, early symptoms, and—above all—the great necessity of protecting children under 3 years of age and all delicate children.

The importance of discovering all contacts at the earliest possible moment and of segregating them, if possible, and the giving of human convalescent immune serum to every young and delicate contact was also stressed. Detailed information was given on the instruction of families having measles cases. Each nurse was furnished with typewritten copies of these instructions. Families under quarantine were furnished copies of the educational measles folder supplied by the State Department of Health.

The epidemic developed, as predicted, in February, 1926. The public was kept informed as to the progress of the epidemic, with constantly repeated urging to call a physician early and to give special care to the child under 3 years of age and to all delicate children.

The department operated with an average of 21 field nurses during the time of the epidemic. The nurses employed by the Department of Public Instruction (20 in number) gave valuable assistance, bringing the total number of nurses available to a ratio of about 1 to each 4700 of population.

At the beginning of the epidemic, Dr. Godfrey, Director of the Division of Communicable Diseases of the New York State Department of Health, detailed one of his nurses to assist in organizing the home visit work of the nurses. The State Health Department also furnished some human immune serum, though most of the serum used was obtained locally from convalescent patients.

Schools were not closed during the epidemic, nor were infant welfare clinics discontinued. Due to our following a generalized nursing plan, it was possible to devote the greater part of the home visit service of the nurses to the search for measles cases and the instruction of families. It was necessary to hospitalize only 24 cases because of home conditions.

STATISTICAL DATA

In dealing with the statistical facts of the 1926-27 measles epidemic in Syracuse, it should be understood that the efforts of the department centered not in the prevention of all measles but in an attempt to protect child life, especially under 3 years of age, and to lower, if possible, the mortality for that age period.

In Table I is presented the total number of cases and deaths, together with the indicated fatality per 100 cases for the epidemics of 1923-24 and 1926-27 respectively, as well as the number of cases and deaths with their fatality at different age periods.

There were reported for the epidemic of 1923-24 of German measles and measles a total of 4,722 cases with 59 deaths, or a fatality of 1.38 per 100 cases as against 5,317 cases of true measles with 18 deaths, a fatality of 0.34 per 100 cases for the epidemic of 1926-27. This seems a fairly favorable showing—the mortality rate for the 1926-27 epidemic representing a 68 per cent reduction from that of the preceding epidemic. This rate seems especially favorable when it is considered that the total number of cases for the epidemic of 1923-24 includes German measles, whereas the total for the 1926-27 epidemic counts true measles only.

TABLE I

MEASLES CASES REPORTED, DEATHS AND CASE FATALITY PER 100 CASES REPORTED, BY AGE GROUPS SYRACUSE, 1926–1927

	1923–1924[1]		*1926–1927*		*Fatality per 100 Cases*	
	Cases	*Deaths*	*Cases*	*Deaths*	*1923–1924*[1]	*1926–1927*
ALL AGES	4722	59	5223	18	1.38	0.34
Under 1 year	119	9	164	5	7.56	3.04
1 year	314	21	324	7	6.68	2.16
2 years	423	14	424	2	3.30	0.47
3 years	481	7	534	2	1.45	0.37
4 years	447	1	537	1	0.22	0.18
5 to 9 years	2492	5	2600	1	0.20	0.03
10 years and over	446	2	640	..	0.44	...

1. Figures for 1923-1924 include German measles, but it is probably unlikely that very many cases were reported; for 1924 only 111 cases of German measles were recorded.

It is interesting and significant also to compare the fatality rate of 0.34 of the 1926-27 epidemic with the modal case fatality rate for cities with a population of 100,000 or more, which, according to Sydenstricker, is about 0.6 (based on 15 years of frequencies). This will give Syracuse a rate of 43 per cent under the average for cities in this population group.

The difference in the mortality rate for the two Syracuse epidemics under consideration shows up even more markedly when these rates are considered by age groups. For children under 1 year of age the 1923-24 epidemic shows 119 cases with 9 deaths, giving a fatality rate of 7.6, as against 164 cases with 5 deaths and a fatality rate of 3.0 for the 1926-27 epidemic.

ANALYSIS OF STATISTICS

For *all* cases under *3 years* the fatality in the 1923-24 epidemic is 5.1, as compared with a rate of 1.6 for the last epidemic. It appears then that the mortality from measles in Syracuse during the 1926-27 epidemic was 69 per cent lower for the age period under 3 years, compared with the immediately preceding epidemic. The question now arises—May we accept that this improvement in mortality stands in any relation to what was done? This in turn calls for an inquiry into:

1. The nature of the epidemic, i.e., was it milder than the preceding one?
2. Was there any material difference in the proportion of susceptibles or in the age distribution in this group?
3. Are there any tangible factors in what was done that could have brought about improved results?

Nature of Epidemic—So far as the first of these questions is concerned, it is of course impossible to give absolute proof as to the virulence of the epidemic in question. There are no bacteriological standards by means of which the virulence of the contagium of measles, whatever it may be, can be tested. Nor is there clinical evidence unless we accept the impressions of the clinician as to the virulence of the epi-

demic of 1926-27 as compared with the one preceding. We must therefore fall back upon a comparison of mortality figures at Syracuse with those of other nearby cities as the only measurable factor on the basis of which the probable virulence of the 1926-27 measles epidemic may be judged.

Taking for this purpose the statistics of measles in the cities of Rochester and Yonkers, both of which reported epidemics of measles in 1926, we find the following:

	Number of cases	*Deaths*	*Fatality per 100 Cases*
Rochester	2437	17	0.70
Yonkers	3782	44	1.16
Syracuse	2714	4	0.16

It is understood, of course, that this represents a comparison for only one year of the epidemic.

The many factors that ordinarily stand as objections in comparing the general mortality of one city with that of another are also fully appreciated. However, notwithstanding all this, it yet seems not unreasonable that the specific mortality for measles in the communities in question should serve as an indicator to the virulence of measles at that time and season and for this section of the country.

TABLE II

MEASLES CASES REPORTED AND PER CENT DISTRIBUTION BY AGES
SYRACUSE, NEW YORK

	Cases Reported		*Per Cent Distribution*	
	1923–1924	*1926–1927*	*1923–1924*	*1926–1927*
	4722	5223	100.0	100.0
Under 1 Year	119	164	2.5	3.2
1 Year	314	324	6.7	6.2
2 Years	423	424	9.0	8.1
3	481	534	10.2	10.2
4	447	537	9.5	10.3
5	681	635	14.4	12.2
6	705	761	14.9	14.6
7	547	549	11.6	10.5
8	373	414	7.9	7.9
9	186	241	3.9	4.6
10–14 Years	287	405	6.1	7.8
15–24	101	154	2.1	2.9
25–34	40	51)		
35–44	14	23)	1.2	1.6
45-54	3	4)		
55–59	1	2)		
60–64		..		
65–69		1		

Figures for 1923-1924 include German measles. See note to Table I.

For all of the three cities in question 1926 was an epidemic year. For all the cities climatic conditions are about the same. For all of the cities the seasonal period of the epidemic was the same. The cities

TABLE III

NUMBER OF MEASLES CONTACTS GIVEN IMMUNE SERUM AND RESULTS, BY AGE GROUPS SYRACUSE, 1926–1927

	Number Given Serum	*Developed Modified Measles*	*No Measles*
ALL AGES	155	74	81
Under 1	38	8	30
1	40	22	18
2	34	24	10
3	22[1]	13	9[1]
4	7[2]	3	4[2]
5	7	2	5
6	2	0	2
7	3[2]	1	2[2]
8	1	1	0
9	0	0	0
10	0	0	0
11	1	0	1

1. Of these 1 has a doubtful history.
2. Of these 1 exposure is probable but not definite.

are in comparatively close proximity to and in communication with one another. It seems difficult under these circumstances to assume that there should have been any marked variation in the virulence of measles for the respective cities which would not have affected all of them. It may be accepted therefore that the factor of virulence in the 1926 epidemic did not materially vary in favor of Syracuse.

Proportion of Susceptibles—We now examine the next point that could have influenced the mortality; namely, the proportion of susceptibles and the difference in the age distribution for this group. The history of measles for Syracuse shows a rather uniform recurrence of epidemics after about 19 months quiescence. Syracuse is a community of rather steady and average growth. There are no marked fluctuations in the loss or additions to her population. Participation of the number of susceptibles in different age groups in the epidemics has been about the same, so that the factor of an abnormal accumulation of susceptibles cannot be considered as a determining point.

In Table II is shown the number of cases according to age group for the epidemic of 1923-24 and that of 1926-27 and the percentage distribution of cases by age for the two epidemics. It will be seen that this is quite uniform for the two epidemics. Of particular interest is the per cent distribution of cases for the age group under 3 years. In the 1923-24 epidemic this group shows 856 cases, or 18 per cent of all cases reported. The 1926-27 epidemic records 930, or 17 per cent, for this same age group.

Factors bringing results—This brings us to a consideration of the third and most material point; namely, What specific results, if any, were noted in relation to specific methods employed? Is there any

TABLE IV

MEASLES CONTACTS GIVEN CONVALESCENT SERUM SPECIFIED TIME AFTER EXPOSURE AND RESULTS OBTAINED

SYRACUSE 1926–1927

Time after first exposure when serum was given	*Children Given Convalescent Serum*		
	Total	*No subsequent Measles*	*Modified Measles*
TOTAL	155	81	74
1 to 4 days	54	34	20
1 day	4	4	..
2 days	14	11	3
3 days	20	13	7
4 days	16 [1]	6 [1]	10
5 to 8 days	94	44	50
5 days	42 [2]	19 [2]	23
6 days	31	16	15
7 days	13	5	8
8 days	8	4	4
Days unknown	7	3	4

1. One of these had a doubtful history.
2. Two of these exposures were probable but not definite.

evidence that the public responded in any way to the educational campaign? It is obviously difficult to answer this question unqualifiedly, especially in such a way that would demonstrate that an improvement in popular interest in the epidemic was noted, since there are no comparable data.

It is nevertheless interesting, and undoubtedly significant, that in an analysis of 726 primary cases of measles during the recent epidemic a physician was called in 653 cases, or nearly 90 per cent, on or before the 4th day of illness. When we consider that a physician is not usually called for what appears to be an uncomplicated cold, such as the symptoms of measles in the preëruptive stage, then we are justified in concluding that this record shows a most remarkable response to the health department's educational effort.

The practice to call a physician before the 5th day after the onset of illness was undoubtedly an advantage in treating children in the under 3 years age group with human immune serum.

Tables III and IV give our experience with the use of human immune serum. Out of a total of 155 patients that received serum, 81 did not develop measles, and 74 developed modified measles. Two cases outside this group that received serum on the 9th and 10th day following exposure developed measles with complications, indicating that serum employed so late after exposure is of course useless. There was no measles fatality in the entire group. Of the entire series of 155 cases treated by serum, 112, or 72.2 per cent, were children under 3 years of age. In this group 54, or 48.2 per cent, developed modified measles; and 58, or 51.7 per cent, did not develop it.

SUMMARY

It is of course clear that, with the experience of but a single epidemic, conclusions must be limited and drawn with care. Insufficient data for the preceding epidemic makes comparison for every point impossible. Nevertheless, the following statements seem warranted:

1. The plan of Brownlee and Godfrey, to concentrate on the age group under 3 years for a reduction in the mortality of measles, seems entirely practical, and has in the management of the 1926-27 epidemic at Syracuse apparently yielded substantial reduction in the mortality of children under 3 years of age.

2. The plan can be most effectively carried out under a generalized nursing system.

3. Useful public interest and coöperation in such a plan can be stimulated and sustained to a remarkable degree by proper publicity.

4. The plan does not require new methods, but merely calls for an intensified application of known procedures.

REFERENCES

1. Tunnicliff, Ruth. The Cultivation of Micrococcus from Blood in Preeruptive and Eruptive Stages of Measles, *J. A. M. A.* 68:1028 (Apr. 7), 1917.
2. Ferry, H. S. and Fisher, L. W. Measles Toxin, *J. A. M. A.* 86:932 (Mar. 27), 1926.
3. Park, W. H., Williams A. W., Wilson, M. The Relation of the Tunnicliff and Ferry Diplococci to Measles, *A. J. P. H.* 17:460 (May), 1927.
4. Degkwitz, Rudolf, Spezifisches Masernschutzserum vom Tier, *München med. Wchnschr.* 73:181, 248 (Jan. 29 and Feb. 5), 1926.
5. Collins, S. D. *Pub. Health Rep.*, June 27, 1924.
6. Godfrey, E. S., Administrative Control of Measles, *A. J. P. H.* 16:571 (June), 1926.
7. Brownlee, J., *Brit. M. J.*, Aug. 17, 1920.
8. Thompson, I. F. Better Health, Syracuse Health Department, July 1926.

The Eleventh Annual Roll Call

SIX hundred and forty-three thousand dollars for 20 disasters abroad, $8,216,893 to relieve 690,000 people as a result of 77 domestic disasters! These are the figures given in the report of the last fiscal year of the American Red Cross.

At the time of the Mississippi Flood, many of those who watched their property being destroyed, or who suffered even greater losses which could not be redeemed by money, learned for the first time the meaning of Red Cross Disaster Relief.

The national and international program of the Red Cross is ever increasing. There are more demands for service and the Red Cross must act in the name of the people of the United States. Is it not fitting, therefore, that the Red Cross should look to the people for the support which larger membership gives? These are the reasons for membership drives:

1. That the files of enrollment in the nursing service may be kept up to date and ready for instant service
2. That disaster equipment may be constantly in readiness
3. That the public health nursing program may be kept going
4. That the teaching of home hygiene and other educational activities may be continued

"Forty-five thousand enrolled Red Cross nurses should be able to influence many times that number of persons to join and thus to participate in the work of the greatest humanitarian agency in the world." In its effort to secure 5,000,000 members the Red Cross offers a challenge to the national pride, conscience and spirit of the American people.